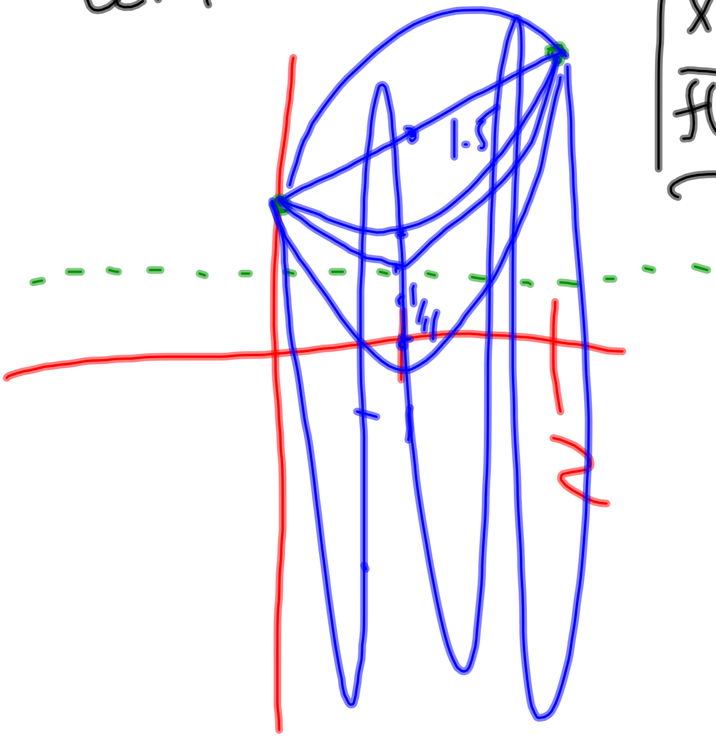
6 (quiz) continuous fn $f(x)$

certain values.

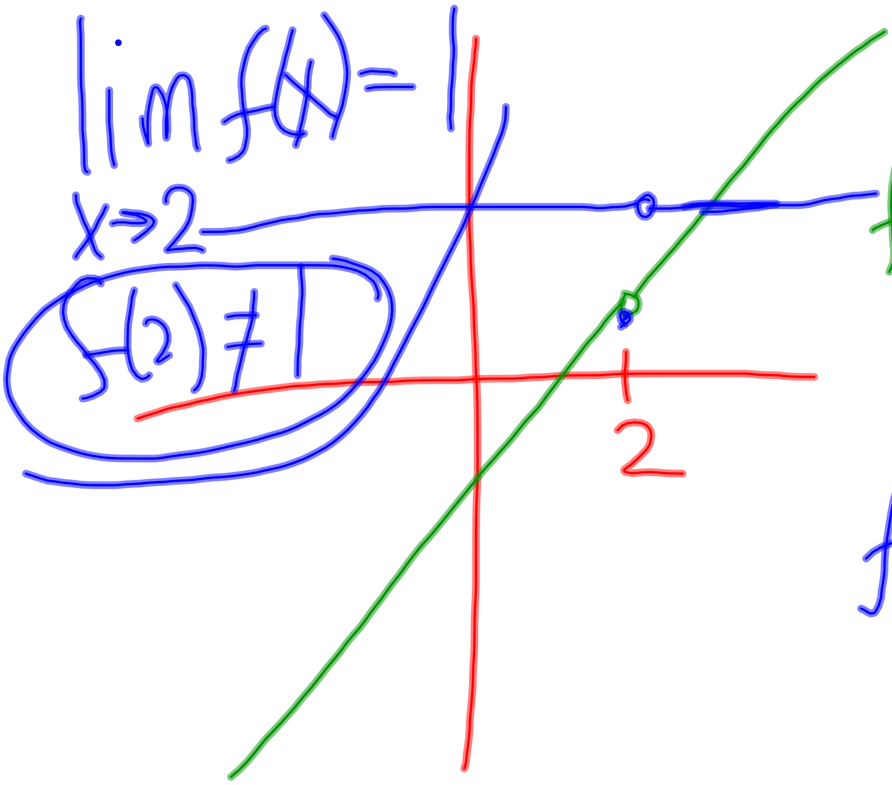
x	0	1	2
$f(x)$	1	k	2



$f(x) = \frac{1}{2}$

$$\lim_{x \to 2} f(x) = 1$$

$f(2) \neq 1$



$$f(x) = \begin{cases} 3, & x \neq 2 \\ 1, & x = 2 \end{cases}$$

$$f(x) = \frac{x(x-2)}{(x-2)}$$

9) $\lim_{x \to 3} \frac{\sqrt{5x+10}}{x-3}$ → 5 / → 0

IDK

DNE

$+\infty$

$-\infty$

2 sided limit

"one and" +

as I approach 3 fr the left I am less than 3 so "x-3" is negative → $-\infty$

as I approach 3 fr the right I will be bigger than 3 so (x-3) is positive → $+\infty$

f, g continuous

$f(2) = 1$

what is $\lim_{x \to 2} g(x)$ if you know $\lim_{x \to 2} [f(x) + 4g(x)] = 13$

$\lim_{x \to 2} g(x) = \frac{13-1}{4}$

$1 + 4x = 13$

14) $\lim_{x \to -\infty} \frac{3-2x}{\sqrt{3x^2-7}}$ $\frac{\to +\infty}{\to +\infty}$ IDK

$= \lim_{x \to -\infty} \frac{x\left(\frac{3}{x}-2\right)}{\sqrt{x^2}\left(\sqrt{3-\frac{7}{x^2}}\right)}$ $= \lim_{x \to -\infty} \frac{x\left(\frac{3}{x}-2\right)}{-x\sqrt{3-\frac{7}{x^2}}}$

$-x \leftarrow |x|$

$= \lim_{x \to -\infty} \frac{\left(\frac{3}{x}-2\right)}{-\sqrt{3-\frac{7}{x^2}}} = \frac{-2}{-\sqrt{3}} = \frac{2}{\sqrt{3}}$

2.6) 1) $\sin(x^2-2) = f(x)$

$\Rightarrow$ find discontinuities

$\Rightarrow$ find domain?

find things that break

$(-\infty, \infty)$ $\therefore$ no discontinuities

i.e. continuous everywhere

$f(1) = \sin((1)^2-2)$

$= \sin(1-2) = \sin(-1)$

$= \pm$ [illegible]

zeros in denom

or negs in even-radicals

2) $\cos\left(\dfrac{x}{x-\pi}\right) = f(x)$

$f(1) =$ "hmmm"

first 1 in for x .... $\dfrac{(1)}{(1)-\pi}$

then take cosine of that.

COMPOSITION of f^n

no even radicals

so zeros in denom?

$x-\pi=0$

YES! when $x=\pi$

$\therefore$ disc. when $x=\pi$

8) $\sqrt{2+\tan^2(x)}$

composition of f^{ns}

$x \longmapsto 2+\tan^2 x \longmapsto \sqrt{}$

$\tan^2 x$ means -notational convention $(\tan x)^2$

Sooooo what do I get for $\tan x^2$? $\tan(x^2)$

Q1 is tan def^n everywhere?

$\tan x := \frac{\sin x}{\cos x}$

$\cos x = 0$?

$$\boxed{x = \frac{\pi}{2} \pm n\pi}$$

any more discs?

i.e. can $2+\tan^2 x$ be Negative?

$\tan^2 x \geq 0$

so

$2+\tan^2 x \geq 2$

None more

$-4^2 = -(4)^2 = -16$

example for thing. preceeding IMMEDIATELY to applies exponent words, other in

$$\lim_{x \to 2} -x^2+4x = 4$$

17) $\lim\limits_{\theta \to 0} \frac{(3)\sin(3\theta)}{(3\theta)} = (3)(1)$

$= 3$

"theta"

"Thursday"

I KNOW $\lim\limits_{x \to 0} \frac{\sin x}{x} = 1$

$\lim\limits_{\theta \to 0} \frac{\sin(3\theta)}{(3\theta)} = ?$

Let $x = 3\theta$

as $\theta \to 0$

$x \to \lim\limits_{\theta \to 0} 3\theta = 0$

$\lim\limits_{x \to 0} \frac{\sin x}{x} = 1$

18)

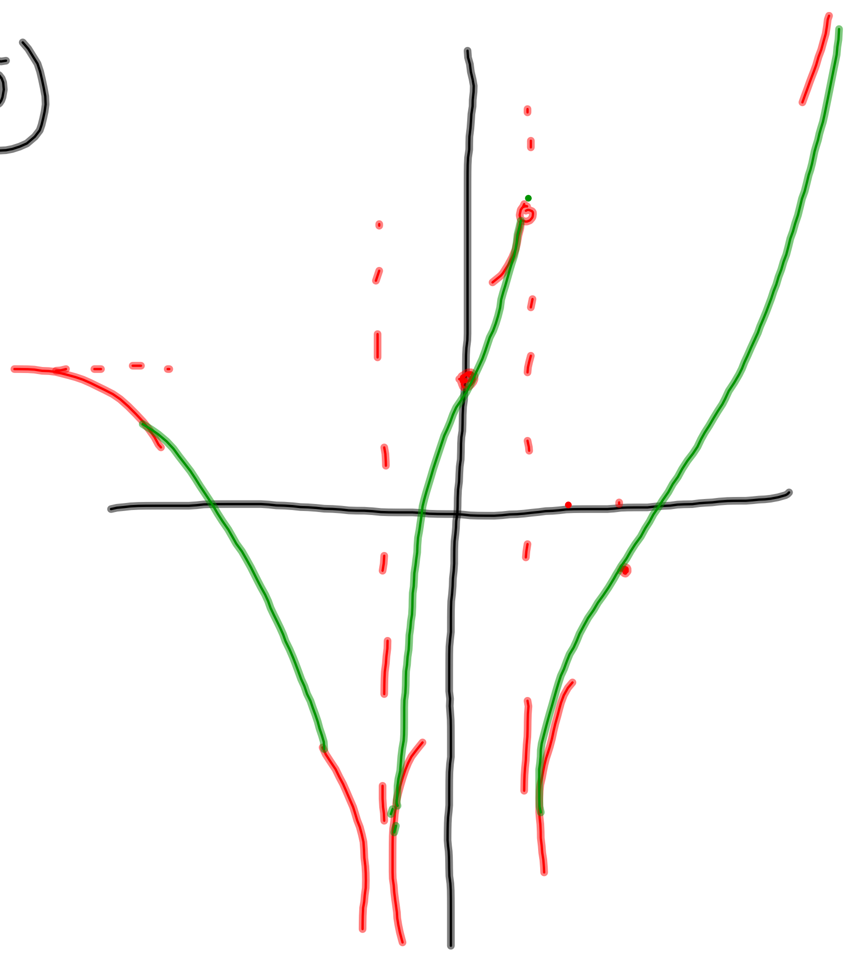
$$\lim_{x \to 0^+} \frac{\sin x}{x^2}$$

$$= \lim_{x \to 0^+} \left(\frac{\sin x}{x}\right)\left(\frac{1}{x}\right)$$

$$= \underbrace{\lim_{x \to 0^+} \left(\frac{\sin x}{x}\right)}_{1} \underbrace{\lim_{x \to 0^+} \left(\frac{1}{x}\right)}_{+\infty}$$

$$= +\infty$$

Q5)



6) $f(x)$ continuous on $[0,2]$

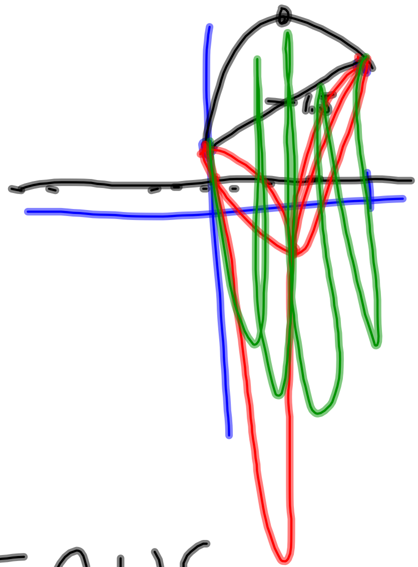
certain values:

x	0	1	2
$f(x)$	1	K	2

Pick a k $\ni$ such that

$f(x) = \frac{1}{2}$

has TWO sol'ns (or more)



SEGUE

$2x + 5 = \frac{1}{2}$

9) $\lim_{x \to 3} \frac{\sqrt{5x+10}}{x-3}$

$\sqrt{5x+10} \to 5$

$x-3 \to$ ☹

IDK

DNE

$+\infty$

$-\infty$

2-sided limit

"x & I"

As we approach 3 fr. left, we are LESS THAN 3, so $x-3$ is under 0 (negative)

$\lim = -\infty$

As we approach 3 fr right, we are always larger than 3, so $x-3$ is positive (and close to 0)

so $\lim_{x \to 3^+} f(x) = +\infty$

lim DNE

$\lim_{x \to 3^-} f(x) = -\infty$

$\lim_{x \to 3^+} f(x) = +\infty$

15)

$$f(x) = \frac{x\,(x-2)}{(x-2)}$$

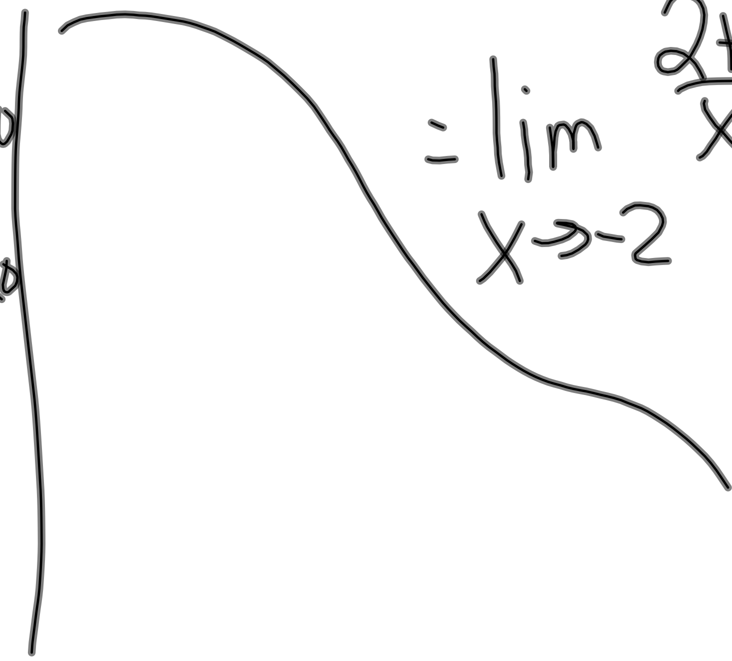
$$f(x) = \begin{cases} 3, & x \neq 2 \\ 1, & x = 2 \end{cases}$$

$$\lim_{x \to 2} f(x) = 3$$

$$f(2) \neq 3$$

12) $\lim\limits_{x \to -2} \frac{2-|x|}{x+2} = \lim\limits_{x \to -2} \frac{2-(-x)}{x+2}$

$|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$



$= \lim\limits_{x \to -2} \frac{2+x}{x+2} = 1$

$$\lim_{x \to -\infty} \frac{3-2x}{\sqrt{3x^2-7}} \Rightarrow \frac{3-2x}{\sqrt{x^2}\sqrt{3-\frac{7}{x^2}}} \Rightarrow \frac{x\left(\frac{3}{x}-2\right)}{|x|\sqrt{3-\frac{7}{x^2}}}$$

$$\Rightarrow \frac{\cancel{x}\left(\frac{3}{x}-2\right)}{-\cancel{x}\sqrt{3-\frac{7}{x^2}}} \Rightarrow \frac{\frac{3}{x}-2}{-\sqrt{3-\frac{7}{x^2}}} \Rightarrow \frac{0-2}{-\sqrt{3-0}}$$

$$\lim_{x \to -\infty} \frac{3-2x}{\sqrt{3x^2-7}} = \frac{2}{\sqrt{3}}$$

2.6) 12)) g(x) is continuous everywhere.

p 163 so is sin(g(x)). why?

- sin x is continuous everywhere.
- No matter what x value I "pass to" sine, it has a value.
- g(x) is cont. everywhere.
- no matter what x-value it "sees", it shows a real number back.
- this real # can be passed to sin.

so if $g(x) = \frac{\pi}{2}$

tan(g(x)) is NEVER defined

suppose sin(g(x)) is not continuous at x = 4.

does g(4) exist?
lets call g(4) = k

then sin(k) exist?

does $\underbrace{\sin(g(x))}_{\text{is a value in } [-1,1]} = g(\sin(x))$?

18)
$$\lim_{x\to 0^+} \frac{\sin(x)}{x^2} = \lim_{x\to 0^+} \left(\frac{\sin x}{x}\right)\left(\frac{1}{x}\right)$$

$$= \left(\lim_{x\to 0^+}\left(\frac{\sin x}{x}\right)\right) \cdot \boxed{\left(\lim_{x\to 0^+} \frac{1}{x}\right)}$$

1 $+\infty$

$= +\infty$

(6) $\displaystyle\lim_{h\to 0} \frac{\sin h}{2h}$

Know:

$\displaystyle\lim_{x\to 0} \frac{\sin x}{x} = 1$

$\displaystyle\lim_{h\to 0} \left(\frac{1}{2}\right)\left(\frac{\sin h}{h}\right)$

$\displaystyle = \frac{1}{2}\lim_{h\to 0} \frac{\sin h}{h} = \left(\frac{1}{2}\right)(1)$

$\displaystyle = \frac{1}{2}$

15) $\lim_{x\to+\infty} \sin\left(\frac{\pi x}{2-3x}\right)$

$= \sin\left(\lim_{x\to\infty} \frac{\pi x}{2-3x}\right) = \sin\left(-\frac{\pi}{3}\right)$

$= -\sin\left(\frac{\pi}{3}\right)$

$= -\frac{\sqrt{3}}{2}$

17) $\lim 3\frac{\sin 3\theta}{3\theta}$

Know $\lim\limits_{x\to 0} \frac{\sin x}{x} = 1$

$3\theta \to 0$

"theta" as $\theta \to 0$

"Thursday"

$\cancel{3}(3\theta) \to 0$

$\therefore \left[\lim\limits_{\theta\to 0} 3\theta = 0\right]$

Let $x = 3\theta$

$\lim\limits_{\theta\to 0} x$

$\lim\limits_{\theta\to 0} 3\theta = 0$

$\lim\limits_{x\to 0} 3\frac{\sin x}{x}$

$\lim\limits_{x\to 0^-} \frac{\sin(x)}{|x|}$

$= 3(1) = 3$

$\therefore$

$\therefore$

$$\lim_{\theta \to 0} \frac{\sin(3\theta)}{\theta}$$

$$= \lim_{\theta \to 0} \frac{3\sin\theta}{\theta} = 3$$